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ACCOUNT

OF A

NEW HYGROMETER,

BY

GEORGE CUMMING, M. D.

ALL THE RIVERS RUN INTO THE SEA; YET THE SEA IS NOT FULL; UNTO THE PLACE FROM WHENCE THE RIVERS COME, THITHER THEY RETURN AGAIN.—*Ecclesiastes, Chap. I.*

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1827.

ACCOUNT, &c.

THE distinguished merits of Mr. Dalton as a Philosopher must be well known to every one conversant with the progress of British Chemistry and Meteorology; and, in common with others, I have ever considered the following experiment for determining the varying force of *Aqueous Vapour* in the atmosphere, as a genuine specimen of cautious, or inductive philosophy. "In order to find the force of the aqueous atmosphere," (says Mr. Dalton in his 'Essay upon the force of steam or vapour from water and other liquids of different temperatures,' 5th vol. page 581, of the 'Memoirs of the Literary and Philosophical Society of Manchester,') "I usually take a tall cylindrical glass jar, dry on the outside, and fill it with cold spring water fresh from the well; if dew be immediately formed on the outside, I pour the water out, let it stand awhile to increase in heat, dry the outside of the glass well with a linen cloth, and then pour the water in again; this operation is to be continued till dew ceases to be formed, and then the temperature of the water must be observed; and opposite to it will be found the force of vapour in the atmosphere. This must be done in the open air, or at a window; because the air within is generally more humid than that without. Spring water is generally about 50°, and will mostly answer the purpose the three hottest months in the year; in other seasons an artifiical cold mixture is required. The accuracy of the result obtained this way I think scarcely needs to be insisted upon. Glass, and all other hard smooth substances, I have tried, when cooled to a degree below what the surrounding Aqueous Vapour can support, cause it to be condensed on their surfaces into water. The degree of cold is usually from 1 to 10 below the mean heat of the 24 hours; in summer I have often observed the point as high as 58° or 59°, corresponding to half an inch of mercury in force, and once or twice have seen at 62°; in changeable and windy weather it is liable to considerable fluctuation." But the great objection to this mode of experimenting, it may be observed, consists in the length of time required to verify an observation, to say nothing of the trouble of employing "an artificial cold mixture" for the greatest part of the year. Hence the satisfaction with which the labours of Mr. Daniel, as well as those of Mr. Jones, to produce a Hygrometer that should readily mark the "comparative degrees of moisture and dryness in the atmosphere, and by exhibiting them in degrees of the Thermometer, refer them to a known standard of comparison, and speak in a language which every body understands," have been received by Meteorologists: and it is but generous to remark, that Mr. Daniel (making every allowance for the imperfections of his Hygrometer, real or supposed) has not been treated, by a certain body of men, with the courtesy which the great zeal, industry, and science, evinced in his "Meteorological Essays," so well entitled him.

It, however, has been well observed that "among the many erroneous views which people take of the origin of the sciences, no one appears more common than that of supposing that they have all been originally undertaken and pursued with some particular aim to public or individual utility; as if the investigation of nature was not valuable; nor natural phenomena capable of exciting us to the pursuit of their causes, on account of the pleasure they produced in engaging the energies of our different intellectual faculties, independently of any further purpose to which they might be made subservient." That Mr. Daniel has had his reward in the ennobling exercise of his mental powers is hardly to be doubted, and therefore the unmerited neglect of the Royal Society, may the more easily be endured; and it reflects infinite credit upon him for "the careful avoidance of all allusion," in the second edition of his Essays, "to subjects which, however intense the personal interest which they excite at the moment of discussion, can be but of ephemeral importance."

Of the merits of the rival Hygrometers of Messrs. Daniel and Jones, it would ill become the author to speak, as an accident upon the road, after waiting with impatience for months for the arrival of Mr Jones's instrument, deprived him of the power of instituting a set of comparative experiments; but should Mr. Daniel's observations upon Mr. Jones's Hygrometer, as published in No. xlii. of the Journal of Science and the Arts, prove correct, the accident above alluded to, may fairly be considered the efficient cause of the production of the following IMPROVED INSTRUMENT.

The Hygrometer in question is extremely simple, and is intimately founded upon the principle pursued by Mr. Dalton in his mode of interrogating nature. But instead of using "a tall cylindrical glass jar, with water fresh from the well, and artificial cold mixtures," I employ the accelerated evaporation of Æther, or of a less costly article, Rectified Spirit of Wine, by directing a current of air through a thin glass or metallic tube, of convenient size, containing a delicate Thermometer enveloped in spouge or other porous substance: when it will be obvious that, by the affusion of a little Æther upon the porous body surrounding the bulb of the Thermometer, almost any degree of artificial cold may be produced by simply mounting the PRERARED TUBE upon the nozzle of a small pair of bellows, or other pneumatic contrivance, thus rendering, by the abstraction of heat from the tube employed, the condensation of Aqueous Vapour upon its exterior surface, a matter of ease, certainty, and expedition, while the comparison of the temperature of the air, at the commencement of the experiment, with the mean of the indications of the Thermometer at the appearance and at the evanescence of the Dew, opposite to the bulb of the Thermometer, will give, with relative accuracy, the measure of the force of Vapour in the atmosphere.

But, in general terms, it is not desirable to depress the instrument many degrees below that at which dew becomes visible, on account of the increased length of time requisite to complete an observation. When the Hygrometer is consulted with a view of predicting the greater or less probability of rain, or other atmospheric changes, two things (Mr. Daniel observes) are to be principally attended to—"the difference between the constituent temperature of the vapour, and the temperature of the air, and the variation of the dew-point. In general, the chance of rain or other precipitation of moisture from the atmosphere, may be regarded as in inverse proportion to the difference between the" Thermometical indications: " but in making this estimate, regard must be had to the time of day at which the observation is made. In settled weather the dryness of the air increases with the diurnal heat, and diminishes with its decline; for the constituent temperature of the vapour remains nearly stationary. But to render the observation most completely prospective, regard must be had at the same time to the movement of the dew-point. As the elasticity of the vapour increases or declines, so does the probability of the formation and continuation of rain. An increasing difference, therefore, between the temperature of the air, and the temperature of the point of condensation, accompanied by a fall of the latter, is a sure prognostication of fine weather; while diminished heat, and a rising dew-point, infallibly portend a rainy season."

The following extracts from Mr. Daniel's Table, shewing the force, weight, and expansion of Aqueous Vapour, at different temperatures, will tend to place the importance of the study of Hygrometry to the Physician, Horticulturist, and Man of Science, in a favourable point of view:

Temperature.	*Force.*	*Weight of a Cubic Foot.*	*Expansion.*
30	0.200	2.361	.9959
35	0.240	2.805	1 0062
40	0 280	3.239	1 0166
45	0 340	3 893	1 0270
50	0 400	4 535	1.0375
55	0.476	5.342	1 0479
60	0 560	6 222	1.0583
65	0 657	7 230	1 0687
70	0.770	8 392	1 0791

Assuming, therefore, that changes in the Aqueous Atmosphere[*] must exercise an important influence upon the general economy of nature: Who is prepared to say that, as a healthy man consumes 130 cubic feet of air daily, the manageable relations of heat and moisture, as indicated by the Hygrometer, might not be beneficially applied to the treatment of disease, as well in private life as in public institutions, or that, were an increased share of attention paid to the study of atmospheric phenomena, the causes, or " constitution of the air," regulating the rise, type, and progress of disease in general, (a subject deeply involved in obscurity) might not happily be developed?

[*] *On the* 17*th July*, 1827, *the dew-point, at ten o'clock a. m. was* 56°, *the temperature of the Atmosphere* 72°; *so that the dryness of the air, under the above conditions, may be conveniently expressed as*---16°, *at noon it was* 14°, *at six o'clock p m. it had advanced to* 10°, *and was followed by considerable rain in the night. On the* 19*th, the dew-point, at noon, was* 61°, *air* 65°, *difference* 4°, *immediately followed by rain. To-day (*26*th) the dew point is* 58°, *attended with much rain, the temperature of the air being* 62°. *But the author has strongly to recommend Mr. Daniel's Essays to the attention of the Meteorological Student; and to adopt his language, (in speaking of his invention) I have only to hope that the* NEW HYGROMETER "*may be judged upon its own merits alone; and if it shall be found to be liable to no errors of construction, and no deterioration, from use or age; if its indications shall prove to be infallible, and strictly comparable, under all circumstances; and if, moreover, it be easy to observe, and its observations applicable without the trouble and uncertainty of* formulaic *calculations, I shall hope that, for the good of science, it may be generally adopted.*"

DESCRIPTION.

FIGURE 1 represents THE PREPARED HYGROMETER TUBE. A. Glass Tube from eight to twelve inches long BB. Brass or other mountings. C. Thermometer enveloped in sponge or other light porous substance and covered with black silk, in order to render the dew more visible when tubes of coloured glass cannot be procured.

FIGURE 2 represents a COMPLETE HYGROMETER as mounted upon the nozzle of a pair of bellows.

FIGURE 3 is a STANDARD INSTRUMENT, mounted upon a bell-glass immersed in a vessel containing water, so as to act, upon turning a stop-lock, as a Gasometer. A is a highly polished thin metallic tube or case, with lateral opening for reading off the degrees of the Thermometer, in a glass tube, (as in the former instruments) but shortened so far as to allow the sponge or other body surrounding the bulb of the Thermometer B, to come in contact with the metallic case, and thereby to make the indications of the same correspond as near as possible with the constituent temperature of the dew upon its exterior surface.

FIGURE 4 is a PORTABLE HYGROMETER with metallic tube or case, as in Figure 3, mounted upon an air-syringe or air-pump. In general terms, polished metallic tubes will be found to possess decided advantages over those of glass, especially when used at night, as with them the verification of the dew-point becomes as easy at night as at mid-day.

☞ *Since the Lithographic Drawings were completed, the following improvement, in fitting up the Instrument above described, has been made, namely the surrounding of the Hygrometer with a glass cover, (of double the diameter of the Hygrometer tube) with openings in the metallic mountings for allowing of the regulated play of the atmosphere: So that by thus protecting the Artificial Dew the Meteorologist will be enabled to make his observations, with accuracy, in the open air, and under every varying circumstance of the weather.*

NEW HYGROMETER.

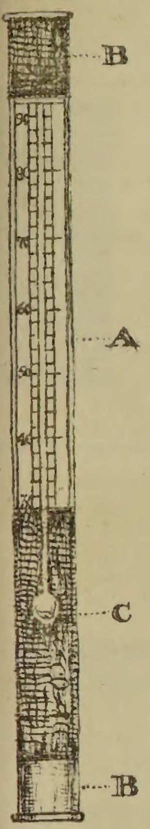


Fig. 2

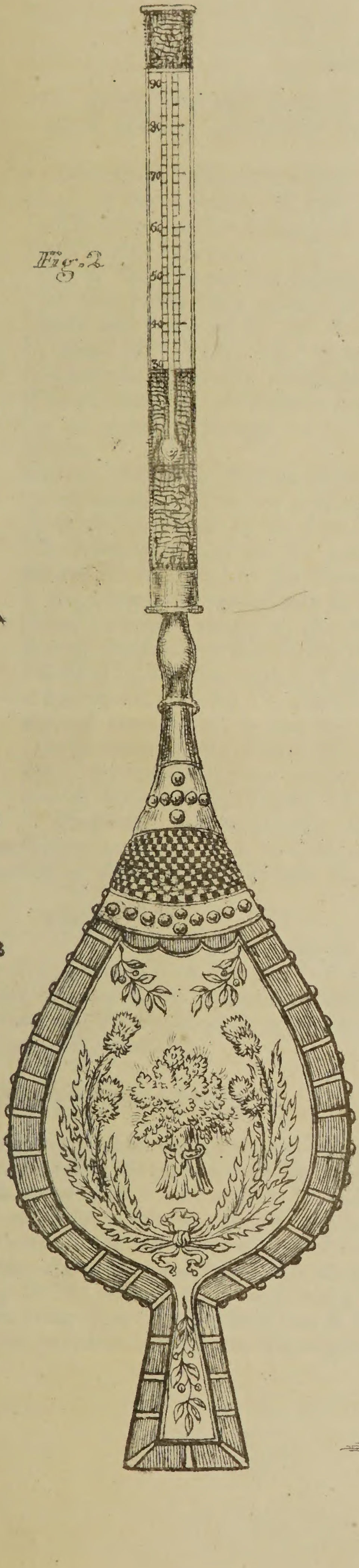


Fig. 3

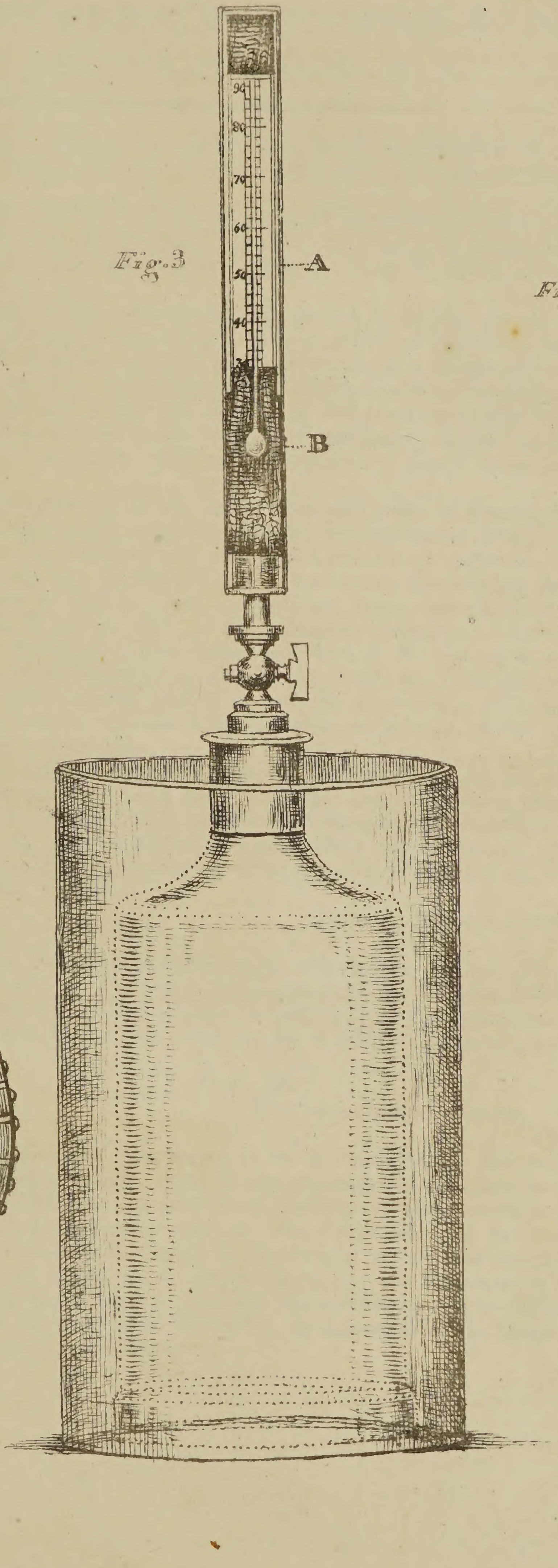
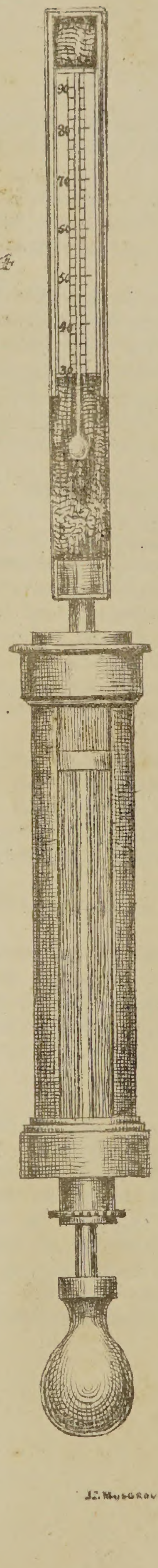


Fig. 4



Jn. Musgrove, Chester. [illegible]